the present with what it was ten years ago, although showing great improvement, still draws a discreditable picture of what so important a profession is allowed to remain in America; and quite a romantic tale is told of the means by which men getting a living by selling false degrees were brought to justice. The number of the universities and other bodies which claim the right to bestow degrees makes the tracking down such forgeries very difficult.

The business of nursing the sick is rising to its proper position as that of an intelligent assistance to the profession of medicine. Cur Report wisely recounts the good results to be gained by student-nurses, though chiefly moral qualities are inculcated.

In the schools of science, the number of students which increased so largely in 18[illegible], but fell off in 1879, has begun to increase again; the number of institutions as well as teachers having increased steadily all the time. Our Report says:—"The multiplication and growth of schools of science has been a marked feature in the recent history of education in America. Either the stimulus given to them by the national aid, or the sentiment which compelled Congress to give help to higher education, has carried forward and deepened the interest in industrial, scientific, and technical instruction. Students are now more frequently choosing lines of study which lead to a life of business activity or to prominent positions in industrial pursuits. Colleges that a few years since held strictly to a rigid classical course are feeling the new impulse and are striving to add to their efficiency by making provision for special instruction preparatory to definite occupations. Men of wealth are endowing schools of science and technology more richly than other institutions; for they believe that the practical education which has now come to the front will do more than anything else to promote the industry and prosperity of individuals, and to utilise the resources of the nation."

The requirements for admission to the scientific department of colleges and schools of science are not so great as to classical collegiate courses.

It is rather curious that the study of Latin is allowed to be dropped in a law school of Harvard; but the following remarks made upon the value of law schools, as compared with that of articling pupils to lawyers, may well be applied not to them only but to all technical instruction:—"In schools systematic training is received. Less opportunity is afforded for desultory and spasmodic reading. Regular habits of study are required. Examinations to be passed give steadiness and thoroughness to the work. Companions make emulation. The desire for the respect of the professors is a further stimulus to faithfulness, and they are ready to aid in the understanding of intricate questions. Underlying principles are given an attention which corresponds to their relative importance."

Forestry is taught in some of the higher institutions, with plantations of trees arranged in their natural orders; and its value is pointed out, both as a branch of knowledge to the students, and also as adding to the knowledge of the range of possible and profitable cultivation of many species.

A system of teaching the deaf and dumb to read from the lips of others instead of the old finger reading is described as wonderfully successful and fast gaining ground.

Not a small advantage will science gain if the system of making full inquiries into the antecedents of every case of the above, as also of blindness, is patiently and thoroughly carried out. Some generalisations have already been made with regard to the latter. In the case of 100 feeble-minded scholars their weakness is traced to consumption in their stock. An inquiry into colour-blindness in the Boston schools leads to the recommendation that a systematic process of giving instruction in colour, its names, and shades, should be introduced into primary schools.

The importance of reform schools is steadily and strongly upheld. The needs of their inmates are wisely consulted by an education more moral than intellectual being instilled into them, and by a knowledge also of some method of gaining a living when dismissed being carefully given to them. The better feelings are drawn out and encouraged by a system of rewards for all good conduct, instead of only punishments for bad. Two curious observations are recorded: one is, that working among flowers has a softening tendency upon such characters; and the other, that prisoners are, in general, singularly short of mathematical ability.

The increase in the number of free libraries since the previous year's Report alone nearly equals the entire number of them in England, making a total nearly reaching 3000. Though many of these are very small and to be compared with school libraries here, yet they average all through 4000 volumes in each. A large increase also is noticeable in Kindergarten schools, in schools for nurses, in deaf and dumb, orphan, and reform schools.

The Bureau is indebted to private enterprise for a competition on the subject of schoolhouse plans organised during the year by the "Plumber and Sanitary Engineer." It has drawn forth from the committee of award a sketch of the qualifications they believed to be necessary for a public school building in a large and densely populated city. They lay down ten primary requisites which every plan ought to contain; and the Commissioner hopes that an impulse has been given by their report, which will not be lost or wasted.

Education, we are told, has become in every section of the country a matter of more active public interest than usual. City and country papers have given a place in their columns to the subject, besides periodicals discussing them. It is rather curious to us in aristocratic England to find not selfishness and stupidity only but demagoguism also charged with creating discouragements! W. O.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Microphone

IT is probable that the writer of the note at p. 588 has not had an opportunity of seeing the paper of mine to which he refers, and an abstract of which is given at p. 376 of the present volume of NATURE.

The adhesion between metallic contacts consequent upon the passage of a current has been carefully investigated by Mr. Stroh, who observed it in the case of all of a great number of metals with which he experimented. My first observations on the subject (one of which is mentioned in the paper) were made with the refractory metal platinum, and not with bismuth, as the writer of the note seems to infer; and though Mr. Stroh's explanation—that the adhesion is due to fusion—is quoted, I express no opinion of my own on the matter. Whatever may be the cause, it seems evident enough that such adhesion must necessarily be detrimental to the perfect action of a microphone, though I am not aware that attention has been previously directed to this point.

It is not correct to attribute to me the opinion, as stated in the note, "that the heat generated by the current plays an important part, for in carbon this reduces the resistance, whilst in metals it increases it." On the contrary I give reasons for believing that at least a moderate degree of heat increases the resistance of loose carbon contacts. Increased *current*, however, is accompanied by diminished resistance, and while I am not prepared to say that heat plays no part whatever in the matter, it appears to me probable that the effect is mainly owing to some other incident of the stronger current, *e.g.* greater difference of potential.

My experiments on metals were not, as the writer supposes, entirely confined to bismuth. More than a hundred observations were recorded of the resistance of platinum and copper contacts under different conditions, and some of these are referred to in the paper. Owing, however, to the low specific resistance of these metals, the methods which I had applied with success in the case of carbon were found to be unsuitable, and the results obtained, though not on the whole inconsistent with those yielded by bismuth, were unsatisfactory and inconclusive. Bismuth was chosen for the bulk of the experiments, principally on account of its bad conductivity, which renders changes in the resistance of the contact easier of observation; but since it was my object to contrast the behaviour of metals with that of carbon (which is infusible), its ready fusibility is another advantage. If I had desired to make a good metallic microphone, I should probably have thought with the writer of the note that bismuth was "the very metal which ought to have been avoided." But for experiments conducted with the object of ascertaining the causes of the generally recognised fact that metals, as a class, are inferior in microphonic efficiency to carbon, it is evident that the metal which gives the poorest microphonic effects is *the very one which ought to be selected,* on account of the probability that with such a metal these causes would be most conspicuous.

As a matter of strict scientific exactness I agree with the writer that "no conclusion of any value as to metals in general can be drawn from experiments on bismuth alone." But since the physical properties with respect to which bismuth differs from carbon, and which have any probable connection with microphonic action, seem to be common in various degrees to all metallic bodies, I venture to predict with tolerable confidence, that if the experiments described in the paper are repeated with suitable apparatus, it will be found that all the conclusions arrived at with regard to bismuth (as summarised in the abstract before referred to) are also true to a greater or less extent for any other ordinary metal. SHELFORD BIDWELL

Wandsworth, April 22

[The necessary brevity of the note to which Mr. Bidwell refers precluded lengthy quotations. At the same time it was only natural to draw attention to the weak point in Mr. Bidwell's argument, namely, that the behaviour of the metals generally could not with any certainty be argued from observations made, as Mr. Bidwell admits, on the very metal which for practical ends ought to be avoided. It is greatly to be wished that Mr. Bidwell will so far further improve the capabilities of his apparatus as not only to be able to get conclusive results with other metals, but also so as to enable him to say why his apparatus gave results that were unsatisfactory and inconclusive with good conducting metals such as platinum and copper.]

The Soaring of Birds

FOR more than twenty years I have watched with admiration the soaring of the black vulture of Jamaica (*Vultur aura*) When once well up in the air it rarely moves its wings, except to change the direction of its flight. It can soar whenever there is even a light wind.

I entirely concur with Mr. Hubert Airy in the main point of his general conclusion, as given in vol. xxvii. p. 592. "Variations in the strength and direction of current" can, as he says, be so "utilised" by birds as to enable them to soar. But a high wind is not necessary; and a downward current, even when approaching the perpendicular, may, if of sufficient velocity, be utilised.

Whenever there is a wind there will be ascending and descending currents in some places. This will be so even in a level plain which presents no considerable obstacles, such as trees or buildings, to the stream of air. The plain will be bounded by hills of varying height, and it will vary in breadth. A stream of water would merely flow more rapidly through the narrower channels; but a stream of air, being highly elastic, will also rise and fall, and it will have its eddies in planes more or less inclined to the horizon, and will often acquire a rolling motion. Assuming the existence of ascending and descending currents, the soaring is a very simple matter. *The bird contrives to remain much longer in the upward currents than in the downward.* It will glide along the ascending side of a wave of air and cut across the descending side. It will make many spiral turns in an ascending current of sufficient amplitude. I have often seen the vulture ascend thus for more than 2000 feet, keeping near a steep mountain side. If the bird encounters a descending current, of which it is instantly aware through the diminished pressure on its wings, it will either wheel to the right or left to get out of it, or, altering the pitch of its wings, will descend swiftly so as to acquire the necessary impetus for a rapid escape, or will do both.

It can also avail itself of inequalities in the velocity of horizontal currents flowing parallel to one another at the same elevation. The bird, let us suppose, encounters a strong horizontal current, as warm as it is rapid, issuing from a mountain valley or a cutting through a forest. Instantly throwing its wings into a plane nearly vertical, it receives on them the force of the current, and in a few seconds acquires its velocity. Pitching its wings also for a downward flight it shoots quickly through the current, having acquired a speed more than sufficient for the recovery of its original elevation. If the current be very strong and very narrow, it need not be horizontal, but may approach the perpendicular. The bird will not remain in it long enough to be carried far down, while it acquires an impetus much more than compensating for the slight loss of elevation. It must be remembered that when the bird is gliding at a high rate of speed, the resistance of the air, through its inertia, to any movement except in the plane of the wings, almost equals that of a solid body, and a change of direction causes a very slight loss of momentum.

What rapidity of currents is necessary for soaring must depend in great measure on the structure of the bird. The vulture is, I believe, comparatively heavy, but I think that, having once acquired speed by a short and steep descent, it can glide through still air (or at right angles through air having a uniform horizontal notion) at the rate of twenty miles an hour, descending not more than one in twenty. If, therefore, the bird could be always in an upward current of only one mile an hour, it could maintain itself in the air. A gentle breeze of ten miles an hour, with one mile an hour of ascent—and a much steeper ascent than this must be frequent enough where there are hills—would suffice to sustain the bird; and as an average of ten miles an hour implies local or occasional gusts of greater velocity, of which the bird knows how to avail itself, it could ascend in such a current, and so be able to work to windward. If besides hills of moderate inclination, there are also trees, walls, houses, the air will often be driven upwards, vertically or nearly so, with as great or even greater speed than that of its average horizontal movement; and of this upward movement the birds avail themselves most skilfully. I have frequently seen the vultures working their way thus against a high wind. Their movements are very irregular. Sometimes, to avoid a violent gust, they will drop almost perpendicularly to within a yard or two of the ground, and shooting abruptly sideways with the high velocity gained by the drop, will get into an upward current in which, if ample enough, they will wheel, or else will cross and recross it, till they have gained a sufficient elevation, and then, taking advantage of a lull, will glide to windward.

With a breeze of only five miles an hour, there will be in many places upward currents of high inclination caused by the usual irregularities of surface. Keeping sometimes in these and sometimes in currents more slightly ascending, for, say, two-